地磁気擾乱時に極域電離圏から赤道電離圏へ侵入する電場の夕方異常

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Evening anomaly of the penetration electric fields at mid-to-equatorial latitudes during geomagnetic disturbances

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The convection electric field is generated by the dynamo in the outer magnetosphere, being transmitted to the polar ionosphere with the Region-1 field-aligned currents and further to the equatorial ionosphere near-instantaneously together with the DP2 ionospheric currents. The transmitted electric field causes significant ionospheric and geomagnetic disturbances at mid and low latitudes concurrently with the high latitude disturbances. The transmitted electric field is detected by the HF Doppler sounders at midlatitude and by the magnetometer at the geomagnetic equator on both the day- and night-sides. A current circuit is completed from the magnetospheric dynamo to the equatorial ionosphere via the polar ionosphere, in which the electric field and currents are transmitted by the Alfven waves in the magnetosphere and by the TM0 mode electromagnetic waves in the Earth-ionosphere waveguide. The magnetosphere-equatorial ionosphere current circuit is completed during geomagnetic disturbances such as the SC, PC, DP2 fluctuations, substorms and storms. The current circuit plays a major role in transporting the electromagnetic energy to the low latitude ionosphere as well as to the polar ionosphere. We will show that the penetration electric fields are enhanced in the evening at midlatitude with the direction same as in the daytime. The evening anomaly is a unique feature of the electric potential supplied by the field-aligned currents.

References

1. Kikuchi, T. (2014), Transmission line model for the near-instantaneous transmission of the ionospheric electric field and currents to the equator, J. Geophys. Res. Space Physics, 119, doi:10.1002/2013JA019515.
2. Kikuchi, T., K. K. Hashimoto, I. Tomizawa, Y. Ebihara, Y. Nishimura, T. Araki, A. Shinbori, B. Veenadhari, T. Tanaka, and T. Nagatsuma (2016), Response of the incompressible ionosphere to the compression of the magnetosphere during the geomagnetic sudden commencements, J. Geophys. Res. Space Physics, 121, doi:10.1002/2015JA022166.
3. Kikuchi, T. and K. K. Hashimoto (2016), Transmission of the Electric Fields to the Low Latitude Ionosphere in the Magnetosphere-Ionosphere Current Circuit, Geoscience Letters, DOI: 10.1186/s40562-016-0035-6.